

What is claimed:

1. An aqueous hydrocarbon fuel emulsion comprising water, fuel, and an emulsifier comprising (a) an amino alkylphenol which is made by reacting alkylphenol, an aldehyde and an amine resulting in an amino alkyl phenol.

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2 The emulsion of claim 1 wherein the amino alkylphenol is in combination with an emulsifier selected from the group consisting of at least one of:

(i) at least one fuel-soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia or an amine, the hydrocarbyl substituent of said acylating agent having about 50 to about 500 carbon atoms;

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(ii) at least one of an ionic or a nonionic compound having a hydrophilic-lipophilic balance (HLB) of about 1 to about 40;

(iii) mixture of (ii) with (i); and

(iv) a water-soluble compound selected from the group consisting of amine salts, ammonium salts, azide compounds, nitrate esters, nitramine, nitro compounds, alkali metal salts, alkaline earth metal salts, in combination with (i), (ii), (iii) or (v);

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(v) the reaction product of polyacidic polymer with at least one fuel soluble product made by reacting at least one hydrocarbyl-substituted carboxylic acid acylating agent with ammonia, an amine or a polyamine;

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and combinations thereof.

3. The emulsion of claim 1 wherein the amino alkylphenol is made by the reaction selected from the group consisting of (a) the reaction of an alkylphenol directly with an aldehyde and an amine resulting in an alkylphenol monomer connected by a methylene group to an amine; (b) the reaction of an alkylphenol with an aldehyde resulting in an oligomer wherein the alkylphenols are bridged with methylene groups, the oligomer is then reacted with more aldehyde and an amine to give a Mannich product; and (c) combinations of (a) and (b).

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4. The emulsion of claim 1 wherein the alkylphenols have an alkyl group selected from C₆ to C₁₇₀ and wherein the alkyl group is linear, branched or a combination thereof.

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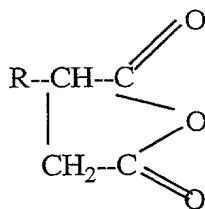
5. The emulsion of claim 1 wherein the alkylphenols are selected from the group consisting of polypropylphenol, polybutylphenol, poly(isobutenyl)phenol, polyamylphenol, tetrapropylphenol, substituted phenols, and combinations thereof.

6. The emulsion of claim 5 wherein the amino alkylphenol is selected from the group consisting of tetrapropenylphenol, poly(isobutenyl)phenol, and combinations thereof.

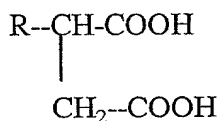
7. The emulsion of claim 1 wherein the aldehydes are selected from the group consisting of aliphatic aldehydes, including, but not limited to, formaldehyde; acetaldehyde; aldol (β -hydroxy butyraldehyde); aromatic aldehydes, selected from the group consisting of benzaldehyde; heterocyclic aldehydes, selected from the group consisting of furfural, and combinations thereof.

8. The emulsion of claim 7 wherein the aldehyde is formaldehyde.

9. The emulsion of claim 1 wherein the amine is selected from the group consisting of alkanolamines selected from the group consisting of monoethanol amine, diethanolamine, N-(2-aminoethyl) ethanolamine, and combinations thereof; di- and polyamines selected from the group consisting of polyalkylene amines, dimethylaminopropylamine, 3-aminopropyl morpholine, ethylenediamine, diethylenetriamine, triethylene tetramine, tetraethylene pentamine, and combinations thereof; distillation bottoms; polyalkyl polyamines; propylene diamine; aromatic amines selected from the group consisting of o-, m- and p-phenylene diamine, diamino naphthalenes; acid-substituted polyalkylpolyamines selected from the group consisting of N-acetyl tetraethylenepentamine, and the corresponding formyl-, propionyl-, butyl-, N-substituted compounds, and combinations thereof; cyclized N-compounds selected from the group consisting of N-alkyl amines of imidazolidine, pyrimidine, and combinations thereof; morpholine, thiomorpholine, pyrrole, pyrroline, pyrrolidine, indole, pyrazole, pyrazoline, pyrazolidine, imidazole, imidazoline, imidazolidine, piperidine, phenoxazine, phenthiazine and their substituted analogs, the product obtained by reacting an alkenyl succinic anhydride of the formula



or alkenyl succinic acid of the formula



and combinations thereof.

5 10. The emulsion of claim 1 wherein the emulsion comprises the emulsifier in the range of about 0.05% to about 20% by weight of the water fuel emulsion, the fuel in the range of about 50% to about 95 % by weight of the water fuel emulsion, and the water in the range of about 1% to about 50% by weight of the water fuel emulsion, and wherein the emulsion has a mean particle droplet in the range of about 0.1 micron to about 1 micron.

10 11. A process for making an aqueous hydrocarbon fuel comprising

(a) mixing a liquid hydrocarbon fuel and at least one emulsifier to form a hydrocarbon fuel emulsifier mixture wherein at least one emulsifier comprises an amino alkylphenol which is the reaction product of an alkylphenol, an aldehyde and an amine; and

15 (b) mixing the hydrocarbon fuel emulsifier mixture with water or water and ammonium nitrate under emulsification conditions to form an aqueous hydrocarbon fuel composition, wherein the aqueous hydrocarbon fuel composition includes a discontinuous phase, the discontinuous aqueous phase being comprised of aqueous droplets having a mean diameter of 1.0 micron or less.

20 12. The emulsion of claim 11 wherein the amino alkylphenol is made by the reaction selected from the group consisting of (a) the reaction of an alkylphenol directly with an aldehyde and an amine resulting in an alkylphenol monomer connected by a methylene group to an amine; (b) the reaction of an alkylphenol with an aldehyde resulting in an oligomer wherein the

alkylphenols are bridged with methylene groups, the oligomer is then reacted with more aldehyde and an amine to give a Mannich product; and (c) combinations of (a) and (b).

13. The process of claim 12 wherein the amino alkylphenol emulsifier has been made
5 by reacting the alkylphenol:aldehyde:amine in reaction (a) in a ratio range of 1:1:0.1 molar to 1:2:2 molar.

14. The process of claim 13 wherein the amino alkylphenol emulsifier has been made
10 by reacting the alkylphenol:aldehyde:amine in reaction (a) in a ratio range of 1:0.9:0.1 to 1:1.9:1.9 molar.

15. The process of claim 14 wherein the amino alkylphenol emulsifier has been made
15 by reacting the alkylphenol:aldehyde:amine in reaction (a) in a ratio range of 1:1.5:1.2 to 1:1.9:1.8 molar.

16. The process of claim 15 wherein the amino alkylphenol emulsifier has been made
by reacting the alkylphenol:aldehyde:amine in reaction (a) in a ratio range of 1:0.8:0.3 to 1:1.5:0.7 molar.

17. The process of claim 11 wherein the reaction is carried out under conditions to
20 provide the formation of the desired product wherein the reaction temperature is in the range of 40°C to about 200°C and the pressure in the range of elevated pressure to reduce pressure and it occurs over a period of time in the range of about 15 minutes to about 8 hours.

18. The process of claim 11 wherein the concentration of the emulsifier in the water-
25 blend fuel is in the range of about 0.05% to about 20% by weight of the total emulsion.

19. The process of claim 12 wherein the reaction (b) is carried out at a temperature
in the range of about 0°C to about 150°C for a period of time ranging from 15 minutes to about
30 8 hours resulting in the oligomer wherein the alkylphenols are bridged with a methylene group;

the intermediate product is reacted in the range of about 1 mole oligomer:about 0.1 mole amine to about 1 mole oligomer:about 2 moles amine.

20. The process of claim 19 wherein the intermediate product is reacted in the range
5 of about 1 mole oligomer:about 0.2 mole amine to about 1 mole oligomer:about 1.5 moles amine.

21. The process of claim 20 wherein the intermediate product is reacted in the range of about 1 mole oligomer:about 0.3 mole amine to about 1 mole oligomer:about 0.9 moles amine.

10 22. A method for fueling an engine comprising fueling the engine with the
composition of claim 1.